



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/US00/02504</p> <p>(22) International Filing Date: 10 February 2000 (10.02.00)</p> <p>(30) Priority Data: 60/119,795 11 February 1999 (11.02.99) US</p> <p>(71)(72) Applicant and Inventor: HUBBELL, David [US/US]; 112 Park Avenue, Saranac Lake, NY 12983 (US).</p> <p>(74) Agent: DE LEON, Josefino, P.; Shlesinger, Arkwright &amp; Garvey LLP, 3000 South Eads Street, Arlington, VA 22202 (US).</p>		<p>(81) Designated States: AU, BR, CA, CH, CN, IL, IN, IS, JP, KR, KZ, MX, NO, NZ, PL, RO, RU, SG, US, ZA, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b>  <i>With international search report.  Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>	
<p>(54) Title: ILLUMINATED, SOLAR POWERED, VEHICLE ACTIVATED, TRAFFIC SIGN</p> <p>(57) Abstract</p> <p>An illuminated sign (R) comprises a front lens (10) having a sign legend (12); an electroluminescent panel (16) disposed behind the lens (10) to provide lighting to the sign legend (12); a power source (26) operably connected to the electroluminescent panel (16); a first sensor (28) responsive to the headlights of an approaching vehicle and connected to the electroluminescent panel (16) to activate the electroluminescent panel (16) upon detection of the headlights; and a second sensor (30) responsive to ambient light and connected to the electroluminescent panel (16) such that the electroluminescent panel (16) is OFF during daylight.</p>			

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ILLUMINATED, SOLAR POWERED, VEHICLE ACTIVATED,  
TRAFFIC SIGN

FIELD OF THE INVENTION

The present invention relates to signs in general and to  
5 illuminated traffic highway signs, in particular, that meet  
the requirements of traffic highway design and traffic highway  
intersection design, signing signaling to improve safety and  
traffic flow on highways and highway intersections.

BACKGROUND OF THE INVENTION

10 Traffic signs, such as STOP signs, are not typically  
directly illuminated. Any illumination they get comes from  
indirect exterior light sources, such as street lights,  
vehicle headlights and other sources. The levels of  
illumination impinging on the signs would be highly variable  
15 at each location, with some signs receiving more than adequate  
illumination and other signs receiving minimal lighting, since  
street lights are generally provided for general illumination.

For traffic signs located in remote areas where utility  
power is not readily available, street lights would not  
20 generally be available to illuminate the traffic signs. In  
these areas, the traffic signs would only be illuminated by  
the vehicle headlights, which could be inadequate. For  
example, where the traffic sign is obscured by a blind curve,  
the sign would not be lit until the driver is almost in front  
25 of it. This may not provide the driver sufficient time to  
react safely.

There is, therefore, a need to have an illuminated traffic sign that is visible to a driver before the vehicle's headlights hit it without depending on ambient lighting sources for illumination.

5       The present invention provides a traffic sign that allows illumination of the sign without extensive maintenance costs and provides for identical appearance of the sign when both lit and unlit, while meeting the design code specifications required by the U.S. Transportation Department of regulatory 10 highway signing set forth in the U.S. Department of Transportation Federal Highway Administration (FHWA) regulations, including NCHRP 350, Manual of Uniform Traffic Control Devices (MUTCD), the American Association of State Highway and Transportation Officials (AASHTO) or other design 15 codes.

#### OBJECTS AND SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an illuminated traffic sign that meets the various design code and regulatory restrictions while avoiding the 20 disadvantages of the prior art.

It is another object of the present invention to provide a traffic sign that meets MUTCD requirements both when not illuminated and also when illuminated.

It is still another object of the present invention to 25 provide a reflective sign which when illuminated either by an interior light source in accordance with the present invention or by an exterior light source, such as a car headlight, will

appear the same to the driver, thereby avoiding confusion for the driving public.

It is a further object of the present invention to provide an illuminated sign which is easily seen at night before the sign's retro-reflective properties are activated by an exterior light source, such as a car's headlights as a car travels around a curve approaching an intersection, since a retro-reflective sign is only visible at night if a car is heading directly at the intersection.

It is another object of the present invention to provide a sign, such as STOP sign, which remains visible at night after an exterior light source is removed from shining directly at the sign. For example, a driver of an automobile can easily see the prior art STOP sign while the headlights are pointed at the sign, but as the car gets closer to the intersection the car's headlight will no longer shine directly on the STOP sign, throwing the sign into darkness.

It is still another object of the present invention to provide a relatively low cost and easy to maintain means of upgrading highway and intersection safety without the cost of exterior sign illumination equipment and/or traffic light signaling equipment.

In summary, the present invention provides a traffic sign illuminated by an interior electroluminescent lamp that meets the federal requirements for traffic signing when the sign is lit or unlit. The lamp may be activated by the vehicle's headlights and/or by radar detection and/or other such means. Utility or solar power, with battery backup, ensures reliable operation for the lamp.

The present invention provides an illuminated sign, comprising a sign panel; a light source disposed to illuminate the sign panel; a power source operably connected to the light source; and first and second switches connected in series between the power source and the light source such that the light source is activated only when the first and second switches are ON, wherein the first switch is turned ON by an approaching vehicle and the second switch is turned ON during daytime.

These and other objects of the present invention will become apparent from the following detailed description.

#### BRIEF DESCRIPTIONS OF THE DRAWINGS

Fig. 1 is a front elevational view of a traffic sign made in accordance with the present invention.

Fig. 2 is an exploded view of a sign panel made in accordance with the present invention.

Fig. 3 is a cross-sectional view taken along line 3-3 in Fig. 1.

Fig. 4 is schematic wiring diagram used in the present invention.

Fig. 5 is a system block diagram of the wiring schematic shown in Fig. 4.

Figs. 6A and 6B show another embodiment of the present invention, showing use of a solar panel.

Fig. 7 is a front elevational view of a post used in the present invention.

Fig. 8 is a cross-sectional view taken along line 7-7 of Fig. 7.

DETAILED DESCRIPTION OF THE INVENTION

The present invention will now be described using a STOP sign for illustrative purposes only and that a person skilled in the art will understand that the present invention can be  
5 used in any type of sign that provides greater visibility after daylight.

A sign R made in accordance with the present invention is disclosed in Fig. 1. The sign R includes a sign panel 2 mounted on a post 4, which is properly anchored in the ground.  
10 The post 4 is made of standard construction, preferably hollow to function as a raceway for the electrical conductors that power the sign panel 2. The post 4 includes a standard break-off feature that allows the post 4 to yield relatively easily when struck by a vehicle. An underground vault 6 provides an  
15 enclosure for the electrical components of the sign R.

The sign panel 2 includes a front lens 10 having a sign legend 12 capable of retro-reflection, as best shown in Fig. 2. The front lens 10 may be injection molded from plastic to form the sign legend 12 and may incorporate a protective surface to protect the legend 12 from UV light and other detrimental effects of the environment caused by pollutants, acid rain, mildew and airborne dust. U.S. Patent No. 5,442,870 discloses an example of the front lens 10.

A backplate 14 provides support for an electroluminescent lamp 16 and the front lens 10. The backplate 14 may be made from injection molded plastic stabilized for UV radiation and incorporates standard mounting means, such as nuts or bolts made of stainless steel that are molded into the backplate 14

with reinforced mounting areas. A plurality of lamps and/or lens may be used in the sign's construction.

The lamp 16 is a solid-state plastic and/or ceramic electroluminescent light source with normal operating voltage 5 of 150 VAC, 350-800 Hz. The lamp 16 will provide about 1.2 Foot Lamberts minimum at the operating voltage at 150 VAC/350 Hz and 6.0 Foot Lamberts minimum at the operating voltage at 150 VAC/800 Hz. The front surface of the lamp 16 is advantageously disposed at a distance from the back surface of 10 the front lens 10 to generate a gap 18 to allow ambient light to enter from the edges 20 to further illuminate the sign 2, as best shown in Fig. 3. The edges 20 are made from translucent plastic materials to allow ambient light to shine into the gap 18.

15 The lamp 16 is powered from standard AC source 22, which is operably connected to a power supply and battery charger 24. A plurality of batteries 26 are disposed within the vault 6 and provide power to the sign 2.

Referring to Figs. 4 and 5, photosensors 28 and 30 or 20 other standard signaling means are provided to control the on/off operation of the sign. The photosensor 30 may be replaced with a standard radar-based sensor or other conventional sensing devices for sensing the approaching vehicle. The photosensors 28 and 30 are wired in series to 25 the power source such that both photosensors must be conducting at the same time to illuminate the sign panel 2. Photosensor 28 may be eliminated where the sign is located in dark areas such as but not limited to tunnels and/or parking garages. The photosensor 28 is automatically activated at

dusk and deactivated at dawn in response to ambient light level. The photosensor 28 is advantageously disposed such that it is shielded from street lights, lights from vehicle, or other sources of artificial light. The photosensor 30 is  
5 activated when it detects a vehicle's headlights. When both photosensors 28 and 30 are on, the lamp 16 is lit and illuminates the front lens 10, making the sign panel 2 quite visible to the driver. The photosensor 30 is advantageously directed down the road to catch an approaching vehicle's  
10 headlights before the vehicle gets near the intersection so that the sign is lit up before the driver reaches the sign. The photosensor 30 is shielded from ambient light and other sources of artificial light. Upon detection of the approaching vehicle, the electroluminescent lamp 16 can be  
15 either simply turned on or be put into a flashing mode.

The photosensors 28 and 30 advantageously extend the life of the lamp by minimizing the time the lamp is on.

The photosensors 28 and 30 are appropriately secured to the post 4 or other advantageous locations.

20 A quick disconnect 32 is provided for disconnecting the power from the lamp 16 in the event that a vehicle impacts and topples the sign support 4, thereby preventing exposure of live wires.

Since the power supply 22 maintains the system batteries  
25 26 at full charge during normal operation, an AC power failure will not affect the operation of the sign as long as battery power is available. To prevent battery damage due to excessive discharge during a prolonged AC power failure, a low voltage disconnect 34 is provided to automatically disconnect

the lamp 16 from the battery power when a battery voltage of 11.2 VDC is reached. The disconnect 34 will automatically reconnect the lamp 16 when battery voltage is back up to 12.1 VDC.

5 A ballast 36 converts 12 VDC output of the power supply 34 or the batteries 26 to 180 VAC at 800 Hz. Since the lamp 16 will not properly operate from a standard residential power outlet at 120 VAC 60 Hz, the economic value of the sign without its power supply is substantially reduced, thereby 10 providing a disincentive to theft. In addition, the vault 6 that houses the power supply to the sign may be disposed underground to further deter theft or vandalism.

15 For an application where utility power is not available, the sign R may be outfitted with a solar panel 36. As best shown in Figs. 6A and 6B. The solar panel 36 is operably connected to the battery charger 24 to charge the batteries 26 during daylight. The solar panel 36 is operably secured to the post 4 and extends forward over the sign panel 2 to advantageously shade the panel from street lighting.

20 The post 4 is shown in greater detail in Figs. 7 and 8. The post R is hollow to function as a conduit for the wiring to the electroluminescent lamp 16 and to the solar panel 36, if used, and other control and monitoring instruments (not shown) that may be mounted on the sign. The post 4 includes 25 an anchor post 38 and anchor sleeve 40.

The front lens 10 advantageously combines electroluminescent illumination from the lamp 16 with the retro-reflective cube corner construction disclosed in U.S. Patent No. 5,442,870. Placement of the electroluminescent

lamp 16 behind the retro-reflective cube corner face creates an internally illuminated highway design which meets the MUTCD requirements for non-internally illuminated traffic sign. The front lens 10 with its transparent areas allows light to pass  
5 through the face of the lens and to hit the face of the back of the lens. The light is then reflected off the smooth and glossy surface and strikes the back of the face where the surrounding exposed cube corners act as a light diffuser. The electroluminescent lamp 16 utilizes the properties of the  
10 front lens 10 when the level of ambient light is too low to illuminate the sign.

While this invention has been described as having preferred design, it is understood that it is capable of further modification, uses and/or adaptations following in  
15 general the principle of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains, and as may be applied to the essential features set forth, and fall within the scope of the invention or the limits of the  
20 appended claims.

I claim:

1. An illuminated sign, comprising:
  - a) a sign panel;
  - b) a light source disposed to illuminate said sign panel;
  - c) a power source operably connected to said light source;
  - d) first and second switches connected in series between said power source and said light source such that said light source is activated only when said first and second switches are ON;
  - e) said first switch is turned ON by an approaching vehicle; and
  - f) said second switch is turned ON during daytime.
- 15 2. An illuminated sign as in claim 1, wherein said sign is a STOP sign.
3. An illuminated sign as in claim 1, wherein said sign is made of plastic.
4. An illuminated sign as in claim 3, wherein said sign includes retro-reflective portions.
- 20 5. An illuminated sign as in claim 1, wherein said light source is a solid-state plastic electroluminescent panel.
6. An illuminated sign as in claim 1, wherein said light source is a solid-state ceramic electroluminescent panel.
- 25 7. An illuminated sign as in claim 6, and further comprising a support disposed behind said electroluminescent panel.
8. An illuminated sign as in claim 7, wherein said support is made of plastic.

9. An illuminated sign as in claim 1, wherein said power source includes a battery.

10. An illuminated sign as in claim 9, wherein said power source includes a disconnect switch to automatically 5 disconnect said battery from said light source when the battery voltage reaches a value.

11. An illuminated sign as in claim 10, wherein said disconnect switch automatically switches said battery to said light source when the battery voltage reaches another value.

10 12. An illuminated sign as in claim 1, wherein said power source includes a ballast.

13. An illuminated sign as in claim 1, wherein:

a) said first and second switches include first and second photosensors, respectively; and

15 b) said first photosensor is turned ON by headlights of an approaching vehicle.

14. An illuminated sign as in claim 1, wherein said first switch is a radar-based sensor to detect an approaching vehicle.

20 15. An illuminated sign as in claim 14, wherein said second photosensor is automatically activated at dusk and de-activated at dawn in response to ambient light level.

16. An illuminated sign as in claim 1, and further comprising:

25 a) a post; and

b) said sign panel and said light source are secured to said post.

17. An illuminated sign as in claim 16, and further comprising a disconnect switch operably connected to said

power supply such that when said post is knocked down, said disconnect switch automatically disconnects said power source from said light source.

18. An illuminated sign as in claim 16, wherein said post includes a break-off portion to allow said post to yield when struck by a vehicle.  
5

19. An illuminated sign as in claim 16, wherein said post is hollow.

20. An illuminated sign as in claim 16, wherein said post includes an anchor portion.  
10

21. An illuminated sign as in claim 1, wherein said power source includes an underground enclosure.

22. An illuminated sign as in claim 1, wherein said power source includes a solar panel.

15 23. An illuminated sign, comprising:

a) a sign panel;

b) a light source disposed to illuminate said sign panel;

c) a power source operably connected to said light

20 source;

d) a first sensor responsive to headlights of an approaching vehicle and connected to said light source to activate said light source upon detection of the headlights;

e) a second sensor responsive to ambient light and  
25 connected to said light source such that said light source is OFF during daylight.

24. An illuminated sign as in claim 23, wherein said light source is an electroluminescent panel disposed behind said sign panel.

25. An illuminated sign as in claim 24, wherein said electroluminescent panel is spaced apart from said sign panel to permit ambient light to enter therebetween.

26. An illuminated sign as in claim 23, wherein said 5 power source includes a battery backup.

27. An illuminated sign as in claim 23, wherein said first and second sensors are photosensors.

28. An illuminated sign, comprising:

a) a front lens having a sign legend;

10 b) an electroluminescent panel disposed behind said lens to provide lighting to said sign legend;

c) a power source operably connected to said electroluminescent panel;

15 d) a first sensor responsive to headlights of an approaching vehicle and connected to said electroluminescent panel to activate said electroluminescent panel upon detection of the headlights; and

20 e) a second sensor responsive to ambient light and connected to said electroluminescent panel such that said electroluminescent panel is OFF during daylight.

29. An illuminated sign as in claim 28, wherein said sign legend is retro-reflective.

30. An illuminated sign as in claim 28, wherein said first and second sensors are photosensors.

25 31. An illuminated sign, comprising:

a) a sign panel;

b) an electroluminescent light source disposed to illuminate said sign panel;

c) a power source operably connected to said light source; and

d) a first sensor responsive to an approaching vehicle and connected to said light source to activate said

5 light source upon detection of the vehicle;

32. An illuminated sign as in claim 31, and further comprising a second sensor responsive to ambient light and connected to said light source such that said light source is OFF during daylight.

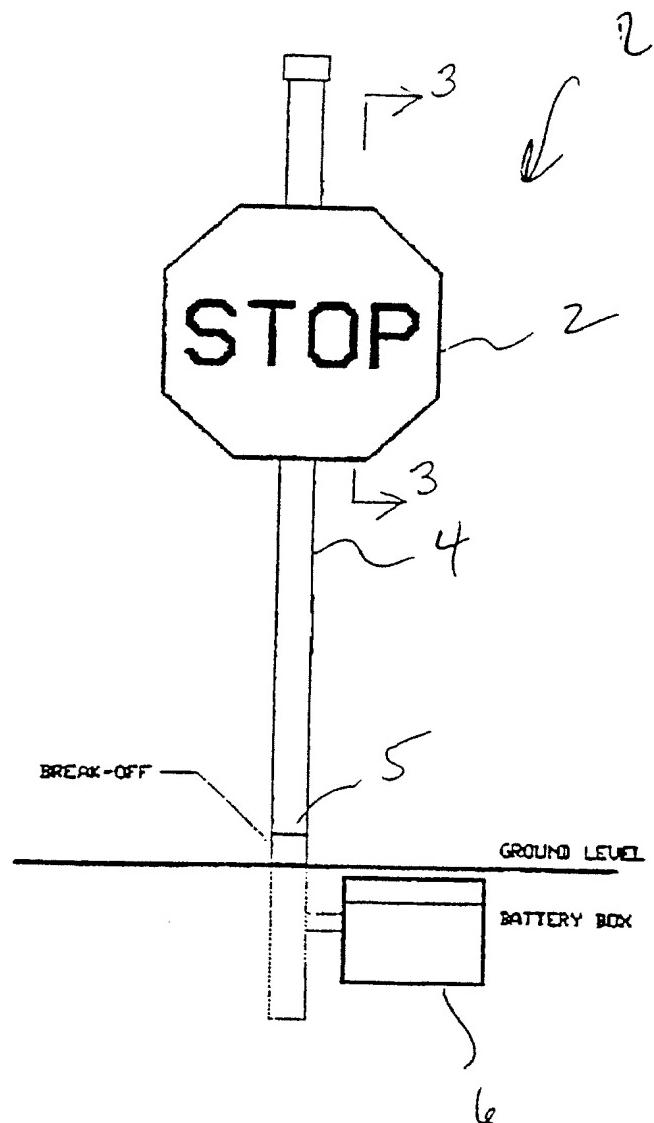
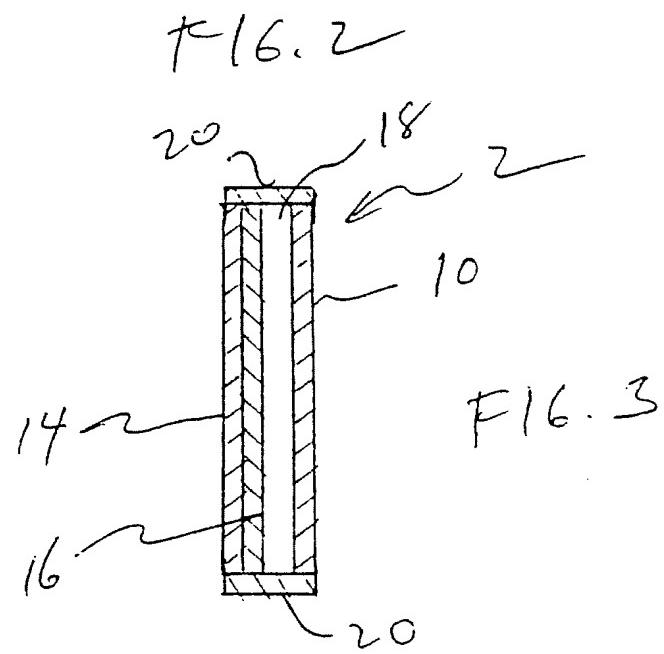
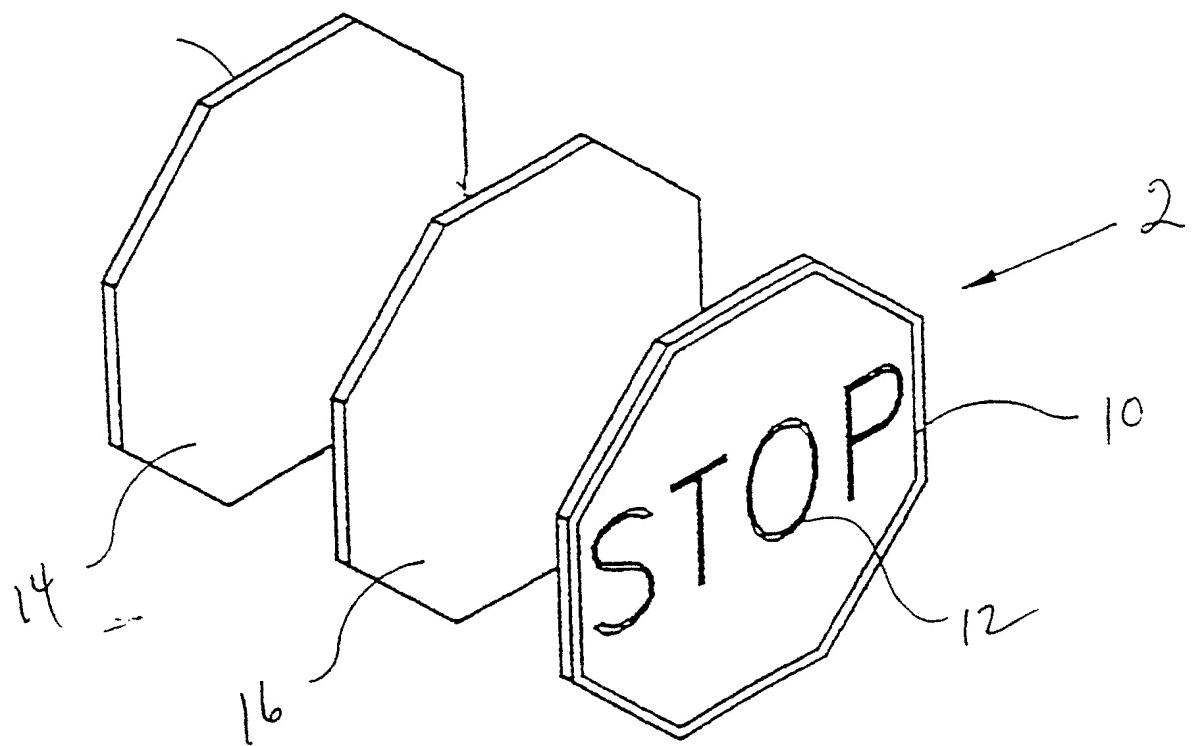
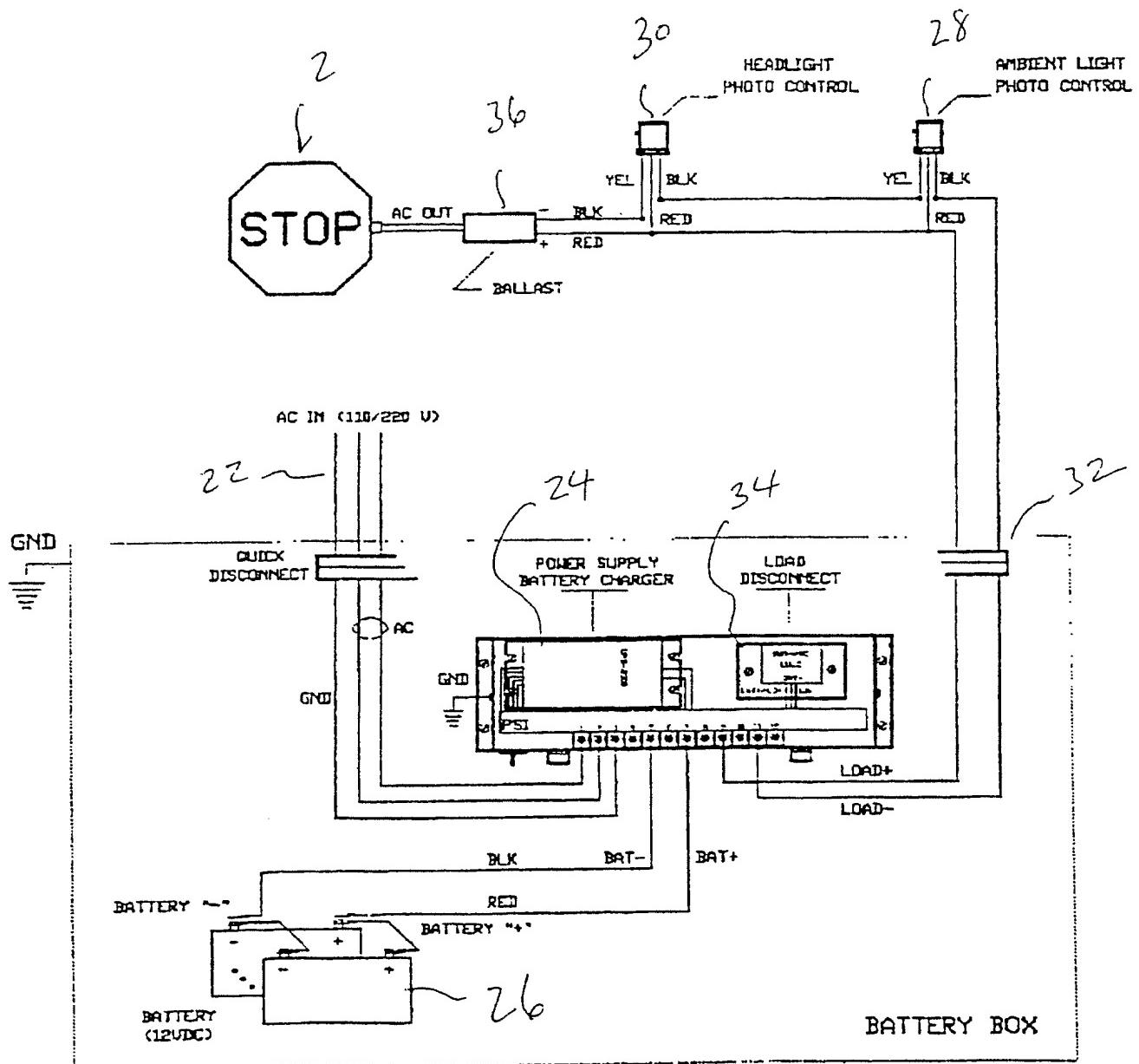
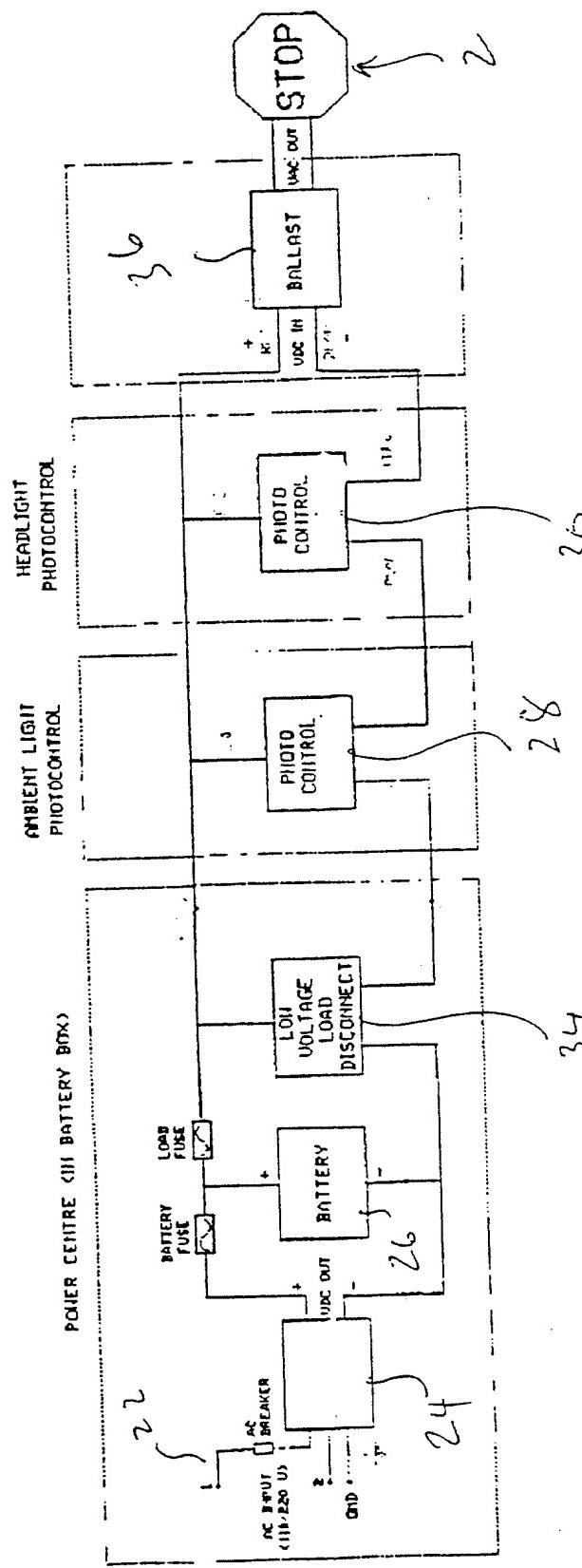


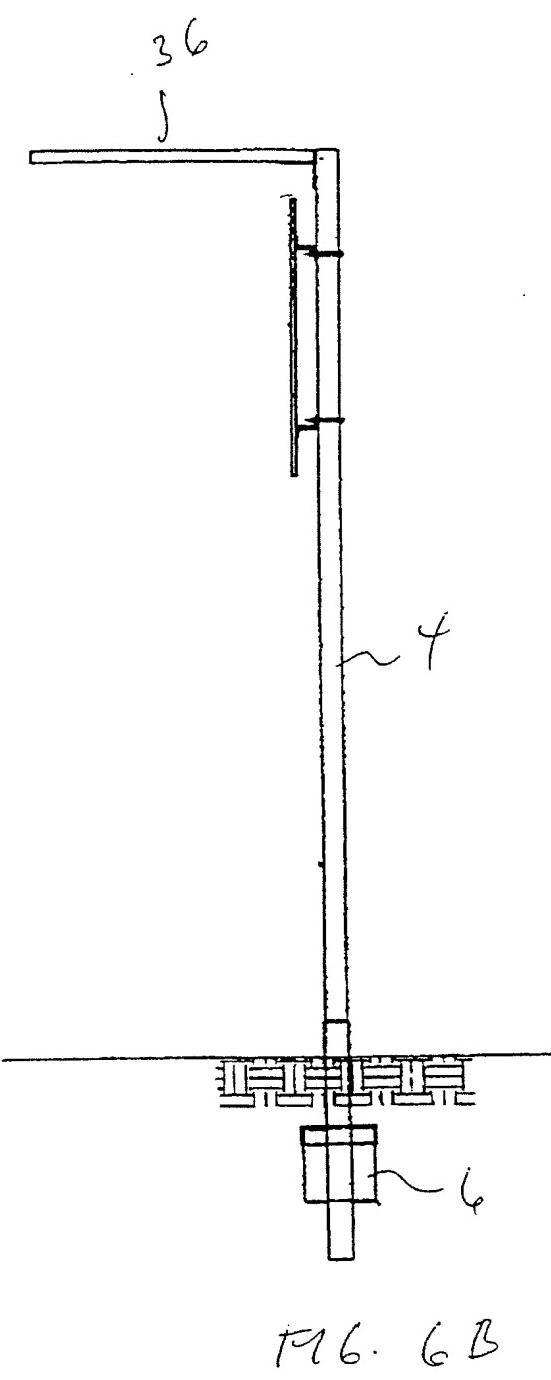
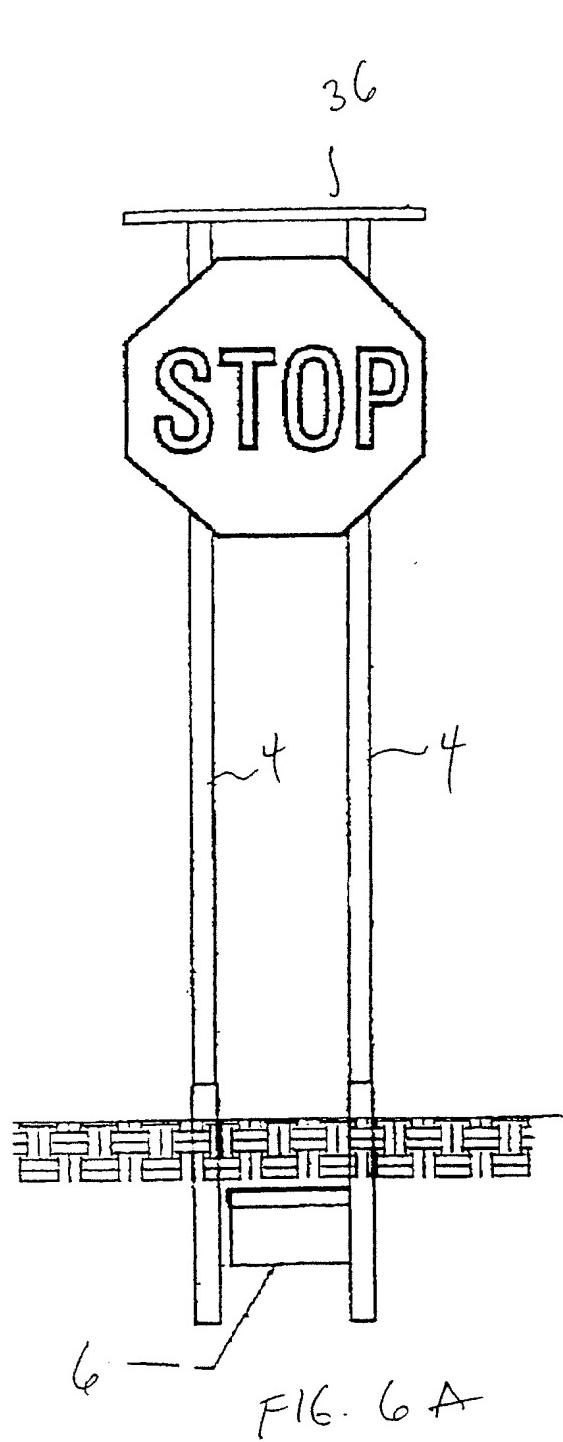
FIG. 1







F16.5



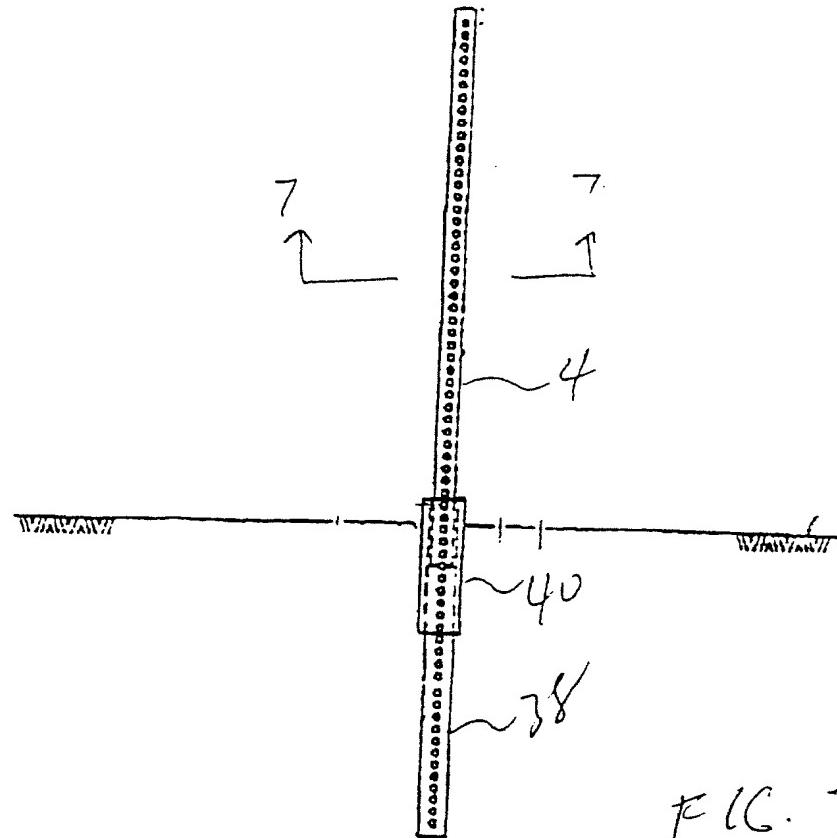


FIG. 7

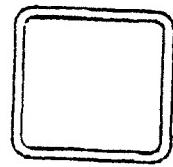


FIG. 8

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US00/02504

<b>A. CLASSIFICATION OF SUBJECT MATTER</b>																				
IPC(7) :G09F 15/00 US CL :40/612, 544, 564; 345/207; 362/812																				
According to International Patent Classification (IPC) or to both national classification and IPC																				
<b>B. FIELDS SEARCHED</b>																				
Minimum documentation searched (classification system followed by classification symbols) U.S. : 40/612, 544, 564, 463; 345/207; 362/812,157,183; 315/156,159,313																				
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched None																				
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) None																				
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>																				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.																		
X	US 5,021,715 A (SMITH ET AL.) 04 JUNE 1991 (04/06/91), see figure 1.	1,2,3,9,16, and 19-22																		
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Y		4-8,10-15, 17,18, and 23-32																		
Y	US 4,952,023 A (BRADSHAW ET AL.) 28 AUGUST 1990 (28/08/90), see figure 1.	4,29,30																		
Y	US 5,709,045 A (THELEN) 20 JANUARY 1998 (20/01/98), see figure 2.	5-8,24,25, 28-32																		
Y	US 4,384,317 A (STACKPOLE) 17 MAY 1983 (17/05/83), see figure 7.	10 and 11																		
Y	US 5,134,550 A (YOUNG) 28 JULY 1992 (28/07/92), see column 3, lines 8-15.	12																		
<input checked="" type="checkbox"/>	Further documents are listed in the continuation of Box C.	<input type="checkbox"/> See patent family annex.																		
<table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">* Special categories of cited documents:</td> <td style="width: 10%; text-align: center;">*T*</td> <td style="width: 60%;">later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</td> </tr> <tr> <td>*A* document defining the general state of the art which is not considered to be of particular relevance</td> <td style="text-align: center;">*X*</td> <td>document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</td> </tr> <tr> <td>*E* earlier document published on or after the international filing date</td> <td style="text-align: center;">*Y*</td> <td>document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td> </tr> <tr> <td>*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td> <td style="text-align: center;">*&amp;*</td> <td>document member of the same patent family</td> </tr> <tr> <td>*O* document referring to an oral disclosure, use, exhibition or other means</td> <td></td> <td></td> </tr> <tr> <td>*P* document published prior to the international filing date but later than the priority date claimed</td> <td></td> <td></td> </tr> </table>			* Special categories of cited documents:	*T*	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	*A* document defining the general state of the art which is not considered to be of particular relevance	*X*	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	*E* earlier document published on or after the international filing date	*Y*	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*&*	document member of the same patent family	*O* document referring to an oral disclosure, use, exhibition or other means			*P* document published prior to the international filing date but later than the priority date claimed		
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Date of the actual completion of the international search 11 MAY 2000		Date of mailing of the international search report <b>05 JUL 2000</b>																		
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230		Authorized officer <b>BRIAN K. GREEN</b> Telephone No. (703) 308-2168																		

Form PCT/ISA/210 (second sheet)(July 1992)\*

**INTERNATIONAL SEARCH REPORT**International application No.  
PCT/US00/02504

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3,720,913 A (BRADFORD) 13 MARCH 1973 (13/03/73), see figure 1.	13-15 and 23-32
Y	US 5,160,111 A (HUGRON) 03 NOVEMBER 1992 (03/11/92), see figure 3.	17 and 18

Form PCT/ISA/210 (continuation of second sheet)(July 1992)★

## CORRECTED VERSION

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
17 August 2000 (17.08.2000)

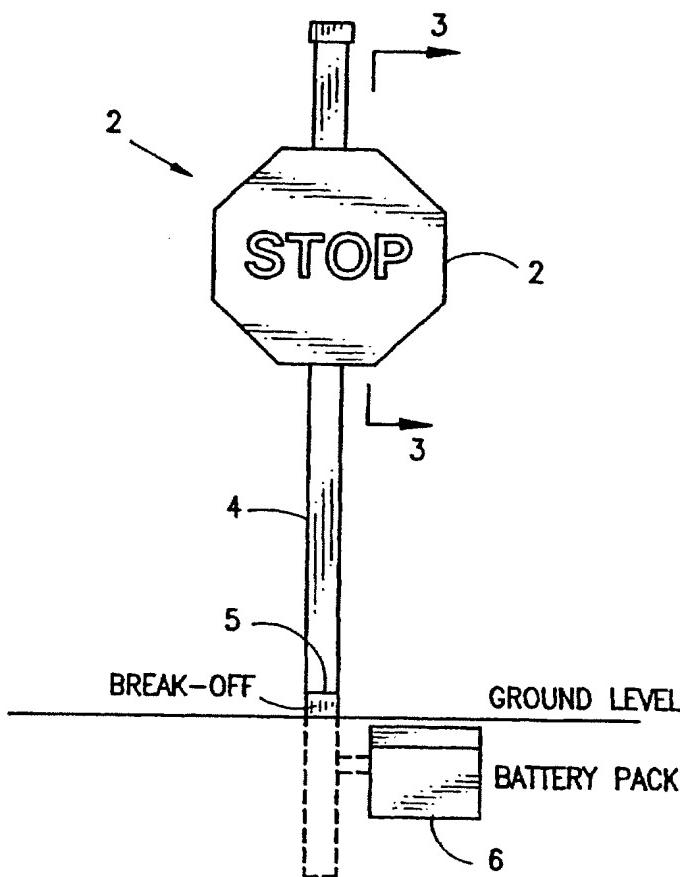
PCT

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| (71) Applicant and                                                                   |                                                       |                                                                                                                                                                                                                                                                                                                         |
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[Continued on next page]

(54) Title: ILLUMINATED, SOLAR POWERED, VEHICLE ACTIVATED, TRAFFIC SIGN



(57) Abstract: An illuminated sign (R) comprises a front lens (10) having a sign legend (12); an electroluminescent panel (16) disposed behind the lens (10) to provide lighting to the sign legend (12); a power source (26) operably connected to the electroluminescent panel (16); a first sensor (28) responsive to the headlights of an approaching vehicle and connected to the electroluminescent panel (16) to activate the electroluminescent panel (16) upon detection of the headlights; and a second sensor (30) responsive to ambient light and connected to the electroluminescent panel (16) such that the electroluminescent panel (16) is OFF during daylight.

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II

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ILLUMINATED, SOLAR POWERED, VEHICLE ACTIVATED,  
TRAFFIC SIGN

FIELD OF THE INVENTION

The present invention relates to signs in general and to  
5 illuminated traffic highway signs, in particular, that meet  
the requirements of traffic highway design and traffic highway  
intersection design, signing signaling to improve safety and  
traffic flow on highways and highway intersections.

BACKGROUND OF THE INVENTION

10 Traffic signs, such as STOP signs, are not typically  
directly illuminated. Any illumination they get comes from  
indirect exterior light sources, such as street lights,  
vehicle headlights and other sources. The levels of  
illumination impinging on the signs would be highly variable  
15 at each location, with some signs receiving more than adequate  
illumination and other signs receiving minimal lighting, since  
street lights are generally provided for general illumination.

For traffic signs located in remote areas where utility  
power is not readily available, street lights would not  
20 generally be available to illuminate the traffic signs. In  
these areas, the traffic signs would only be illuminated by  
the vehicle headlights, which could be inadequate. For  
example, where the traffic sign is obscured by a blind curve,  
the sign would not be lit until the driver is almost in front  
25 of it. This may not provide the driver sufficient time to  
react safely.

There is, therefore, a need to have an illuminated traffic sign that is visible to a driver before the vehicle's headlights hit it without depending on ambient lighting sources for illumination.

5       The present invention provides a traffic sign that allows illumination of the sign without extensive maintenance costs and provides for identical appearance of the sign when both lit and unlit, while meeting the design code specifications required by the U.S. Transportation Department of regulatory  
10      highway signing set forth in the U.S. Department of Transportation Federal Highway Administration (FHWA) regulations, including NCHRP 350, Manual of Uniform Traffic Control Devices (MUTCD), the American Association of State Highway and Transportation Officials (AASHTO) or other design  
15      codes.

#### OBJECTS AND SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an illuminated traffic sign that meets the various design code and regulatory restrictions while avoiding the  
20      disadvantages of the prior art.

It is another object of the present invention to provide a traffic sign that meets MUTCD requirements both when not illuminated and also when illuminated.

It is still another object of the present invention to provide a reflective sign which when illuminated either by an  
25      interior light source in accordance with the present invention or by an exterior light source, such as a car headlight, will

appear the same to the driver, thereby avoiding confusion for the driving public.

It is a further object of the present invention to provide an illuminated sign which is easily seen at night before the sign's retro-reflective properties are activated by an exterior light source, such as a car's headlights as a car travels around a curve approaching an intersection, since a retro-reflective sign is only visible at night if a car is heading directly at the intersection.

It is another object of the present invention to provide a sign, such as STOP sign, which remains visible at night after an exterior light source is removed from shining directly at the sign. For example, a driver of an automobile can easily see the prior art STOP sign while the headlights are pointed at the sign, but as the car gets closer to the intersection the car's headlight will no longer shine directly on the STOP sign, throwing the sign into darkness.

It is still another object of the present invention to provide a relatively low cost and easy to maintain means of upgrading highway and intersection safety without the cost of exterior sign illumination equipment and/or traffic light signaling equipment.

In summary, the present invention provides a traffic sign illuminated by an interior electroluminescent lamp that meets the federal requirements for traffic signing when the sign is lit or unlit. The lamp may be activated by the vehicle's headlights and/or by radar detection and/or other such means. Utility or solar power, with battery backup, ensures reliable operation for the lamp.

The present invention provides an illuminated sign, comprising a sign panel; a light source disposed to illuminate the sign panel; a power source operably connected to the light source; and first and second switches connected in series between the power source and the light source such that the light source is activated only when the first and second switches are ON, wherein the first switch is turned ON by an approaching vehicle and the second switch is turned ON during daytime.

These and other objects of the present invention will become apparent from the following detailed description.

BRIEF DESCRIPTIONS OF THE DRAWINGS

Fig. 1 is a front elevational view of a traffic sign made in accordance with the present invention.

Fig. 2 is an exploded view of a sign panel made in accordance with the present invention.

Fig. 3 is a cross-sectional view taken along line 3-3 in Fig. 1.

Fig. 4 is schematic wiring diagram used in the present invention.

Fig. 5 is a system block diagram of the wiring schematic shown in Fig. 4.

Figs. 6A and 6B show another embodiment of the present invention, showing use of a solar panel.

Fig. 7 is a front elevational view of a post used in the present invention.

Fig. 8 is a cross-sectional view taken along line 7-7 of Fig. 7.

DETAILED DESCRIPTION OF THE INVENTION

The present invention will now be described using a STOP sign for illustrative purposes only and that a person skilled in the art will understand that the present invention can be  
5 used in any type of sign that provides greater visibility after daylight.

A sign R made in accordance with the present invention is disclosed in Fig. 1. The sign R includes a sign panel 2 mounted on a post 4, which is properly anchored in the ground.  
10 The post 4 is made of standard construction, preferably hollow to function as a raceway for the electrical conductors that power the sign panel 2. The post 4 includes a standard break-off feature that allows the post 4 to yield relatively easily when struck by a vehicle. An underground vault 6 provides an  
15 enclosure for the electrical components of the sign R.

The sign panel 2 includes a front lens 10 having a sign legend 12 capable of retro-reflection, as best shown in Fig. 2. The front lens 10 may be injection molded from plastic to form the sign legend 12 and may incorporate a protective surface to protect the legend 12 from UV light and other detrimental effects of the environment caused by pollutants, acid rain, mildew and airborne dust. U.S. Patent No. 5,442,870 discloses an example of the front lens 10.

A backplate 14 provides support for an electroluminescent lamp 16 and the front lens 10. The backplate 14 may be made from injection molded plastic stabilized for UV radiation and incorporates standard mounting means, such as nuts or bolts made of stainless steel that are molded into the backplate 14

with reinforced mounting areas. A plurality of lamps and/or lens may be used in the sign's construction.

The lamp 16 is a solid-state plastic and/or ceramic electroluminescent light source with normal operating voltage 5 of 150 VAC, 350-800 Hz. The lamp 16 will provide about 1.2 Foot Lamberts minimum at the operating voltage at 150 VAC/350 Hz and 6.0 Foot Lamberts minimum at the operating voltage at 150 VAC/800 Hz. The front surface of the lamp 16 is advantageously disposed at a distance from the back surface of 10 the front lens 10 to generate a gap 18 to allow ambient light to enter from the edges 20 to further illuminate the sign 2, as best shown in Fig. 3. The edges 20 are made from translucent plastic materials to allow ambient light to shine into the gap 18.

15 The lamp 16 is powered from standard AC source 22, which is operably connected to a power supply and battery charger 24. A plurality of batteries 26 are disposed within the vault 6 and provide power to the sign 2.

Referring to Figs. 4 and 5, photosensors 28 and 30 or 20 other standard signaling means are provided to control the on/off operation of the sign. The photosensor 30 may be replaced with a standard radar-based sensor or other conventional sensing devices for sensing the approaching vehicle. The photosensors 28 and 30 are wired in series to 25 the power source such that both photosensors must be conducting at the same time to illuminate the sign panel 2. Photosensor 28 may be eliminated where the sign is located in dark areas such as but not limited to tunnels and/or parking garages. The photosensor 28 is automatically activated at

dusk and deactivated at dawn in response to ambient light level. The photosensor 28 is advantageously disposed such that it is shielded from street lights, lights from vehicle, or other sources of artificial light. The photosensor 30 is  
5 activated when it detects a vehicle's headlights. When both photosensors 28 and 30 are on, the lamp 16 is lit and illuminates the front lens 10, making the sign panel 2 quite visible to the driver. The photosensor 30 is advantageously directed down the road to catch an approaching vehicle's  
10 headlights before the vehicle gets near the intersection so that the sign is lit up before the driver reaches the sign. The photosensor 30 is shielded from ambient light and other sources of artificial light. Upon detection of the approaching vehicle, the electroluminescent lamp 16 can be  
15 either simply turned on or be put into a flashing mode.

The photosensors 28 and 30 advantageously extend the life of the lamp by minimizing the time the lamp is on.

The photosensors 28 and 30 are appropriately secured to the post 4 or other advantageous locations.

20 A quick disconnect 32 is provided for disconnecting the power from the lamp 16 in the event that a vehicle impacts and topples the sign support 4, thereby preventing exposure of live wires.

Since the power supply 22 maintains the system batteries  
25 26 at full charge during normal operation, an AC power failure will not affect the operation of the sign as long as battery power is available. To prevent battery damage due to excessive discharge during a prolonged AC power failure, a low voltage disconnect 34 is provided to automatically disconnect

the lamp 16 from the battery power when a battery voltage of 11.2 VDC is reached. The disconnect 34 will automatically reconnect the lamp 16 when battery voltage is back up to 12.1 VDC.

5 A ballast 36 converts 12 VDC output of the power supply 34 or the batteries 26 to 180 VAC at 800 Hz. Since the lamp 16 will not properly operate from a standard residential power outlet at 120 VAC 60 Hz, the economic value of the sign without its power supply is substantially reduced, thereby 10 providing a disincentive to theft. In addition, the vault 6 that houses the power supply to the sign may be disposed underground to further deter theft or vandalism.

For an application where utility power is not available, the sign R may be outfitted with a solar panel 36. As best 15 shown in Figs. 6A and 6B. The solar panel 36 is operably connected to the battery charger 24 to charge the batteries 26 during daylight. The solar panel 36 is operably secured to the post 4 and extends forward over the sign panel 2 to advantageously shade the panel from street lighting.

20 The post 4 is shown in greater detail in Figs. 7 and 8. The post R is hollow to function as a conduit for the wiring to the electroluminescent lamp 16 and to the solar panel 36, if used, and other control and monitoring instruments (not shown) that may be mounted on the sign. The post 4 includes 25 an anchor post 38 and anchor sleeve 40.

The front lens 10 advantageously combines electroluminescent illumination from the lamp 16 with the retro-reflective cube corner construction disclosed in U.S. Patent No. 5,442,870. Placement of the electroluminescent

lamp 16 behind the retro-reflective cube corner face creates an internally illuminated highway design which meets the MUTCD requirements for non-internally illuminated traffic sign. The front lens 10 with its transparent areas allows light to pass  
5 through the face of the lens and to hit the face of the back of the lens. The light is then reflected off the smooth and glossy surface and strikes the back of the face where the surrounding exposed cube corners act as a light diffuser. The electroluminescent lamp 16 utilizes the properties of the  
10 front lens 10 when the level of ambient light is too low to illuminate the sign.

While this invention has been described as having preferred design, it is understood that it is capable of further modification, uses and/or adaptations following in  
15 general the principle of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains, and as may be applied to the essential features set forth, and fall within the scope of the invention or the limits of the  
20 appended claims.

I claim:

1. An illuminated sign, comprising:
  - a) a sign panel;
  - b) a light source disposed to illuminate said sign panel;
  - c) a power source operably connected to said light source;
  - d) first and second switches connected in series between said power source and said light source such that said light source is activated only when said first and second switches are ON;
  - e) said first switch is turned ON by an approaching vehicle; and
  - f) said second switch is turned ON during daytime.
- 15 2. An illuminated sign as in claim 1, wherein said sign is a STOP sign.
3. An illuminated sign as in claim 1, wherein said sign is made of plastic.
4. An illuminated sign as in claim 3, wherein said sign includes retro-reflective portions.
- 20 5. An illuminated sign as in claim 1, wherein said light source is a solid-state plastic electroluminescent panel.
6. An illuminated sign as in claim 1, wherein said light source is a solid-state ceramic electroluminescent panel.
- 25 7. An illuminated sign as in claim 6, and further comprising a support disposed behind said electroluminescent panel.
8. An illuminated sign as in claim 7, wherein said support is made of plastic.

9. An illuminated sign as in claim 1, wherein said power source includes a battery.

10. An illuminated sign as in claim 9, wherein said power source includes a disconnect switch to automatically disconnect said battery from said light source when the 5 battery voltage reaches a value.

11. An illuminated sign as in claim 10, wherein said disconnect switch automatically switches said battery to said light source when the battery voltage reaches another value.

10 12. An illuminated sign as in claim 1, wherein said power source includes a ballast.

13. An illuminated sign as in claim 1, wherein:

a) said first and second switches include first and second photosensors, respectively; and

15 b) said first photosensor is turned ON by headlights of an approaching vehicle.

14. An illuminated sign as in claim 1, wherein said first switch is a radar-based sensor to detect an approaching vehicle.

20 15. An illuminated sign as in claim 14, wherein said second photosensor is automatically activated at dusk and de-activated at dawn in response to ambient light level.

16. An illuminated sign as in claim 1, and further comprising:

25 a) a post; and

b) said sign panel and said light source are secured to said post.

17. An illuminated sign as in claim 16, and further comprising a disconnect switch operably connected to said

power supply such that when said post is knocked down, said disconnect switch automatically disconnects said power source from said light source.

18. An illuminated sign as in claim 16, wherein said post includes a break-off portion to allow said post to yield when struck by a vehicle.  
5

19. An illuminated sign as in claim 16, wherein said post is hollow.

20. An illuminated sign as in claim 16, wherein said post includes an anchor portion.  
10

21. An illuminated sign as in claim 1, wherein said power source includes an underground enclosure.

22. An illuminated sign as in claim 1, wherein said power source includes a solar panel.

15 23. An illuminated sign, comprising:

a) a sign panel;

b) a light source disposed to illuminate said sign panel;

c) a power source operably connected to said light source;  
20

d) a first sensor responsive to headlights of an approaching vehicle and connected to said light source to activate said light source upon detection of the headlights;

e) a second sensor responsive to ambient light and  
25 connected to said light source such that said light source is OFF during daylight.

24. An illuminated sign as in claim 23, wherein said light source is an electroluminescent panel disposed behind said sign panel.

25. An illuminated sign as in claim 24, wherein said electroluminescent panel is spaced apart from said sign panel to permit ambient light to enter therebetween.

26. An illuminated sign as in claim 23, wherein said  
5 power source includes a battery backup.

27. An illuminated sign as in claim 23, wherein said first and second sensors are photosensors.

28. An illuminated sign, comprising:

a) a front lens having a sign legend;

10 b) an electroluminescent panel disposed behind said lens to provide lighting to said sign legend;

c) a power source operably connected to said electroluminescent panel;

15 d) a first sensor responsive to headlights of an approaching vehicle and connected to said electroluminescent panel to activate said electroluminescent panel upon detection of the headlights; and

20 e) a second sensor responsive to ambient light and connected to said electroluminescent panel such that said electroluminescent panel is OFF during daylight.

29. An illuminated sign as in claim 28, wherein said sign legend is retro-reflective.

30. An illuminated sign as in claim 28, wherein said first and second sensors are photosensors.

25 31. An illuminated sign, comprising:

a) a sign panel;

b) an electroluminescent light source disposed to illuminate said sign panel;

c) a power source operably connected to said light source; and

d) a first sensor responsive to an approaching vehicle and connected to said light source to activate said 5 light source upon detection of the vehicle;

32. An illuminated sign as in claim 31, and further comprising a second sensor responsive to ambient light and connected to said light source such that said light source is OFF during daylight.

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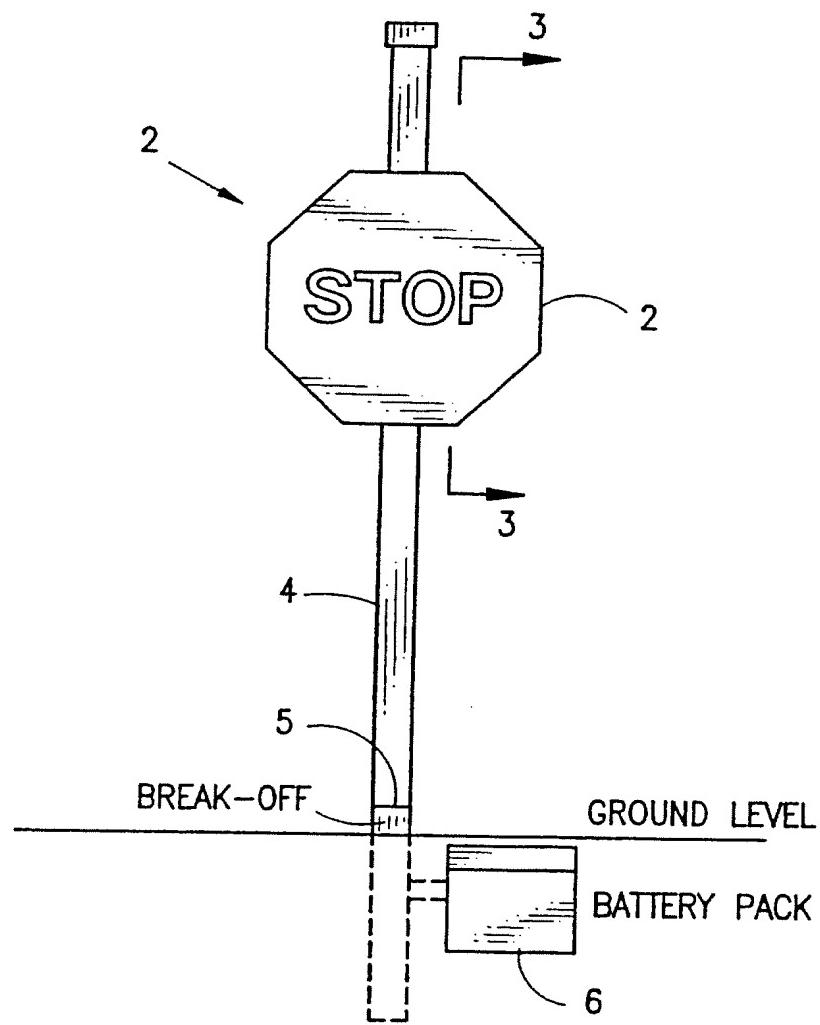


FIG. 1

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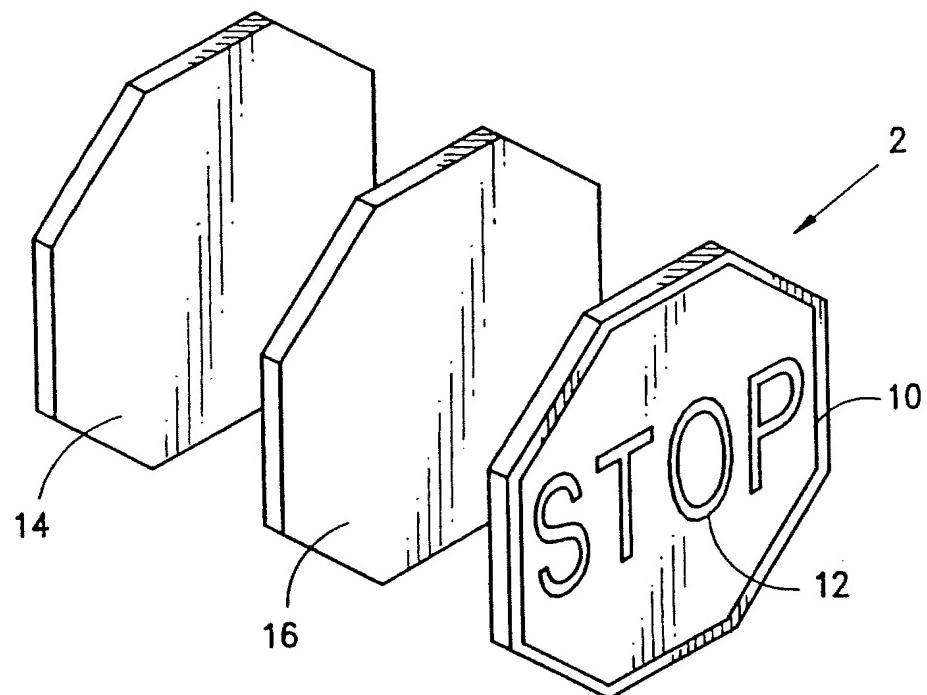


FIG. 2

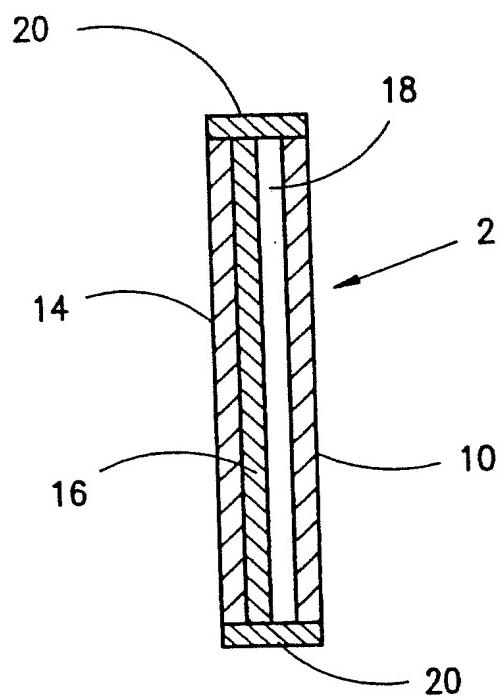


FIG. 3

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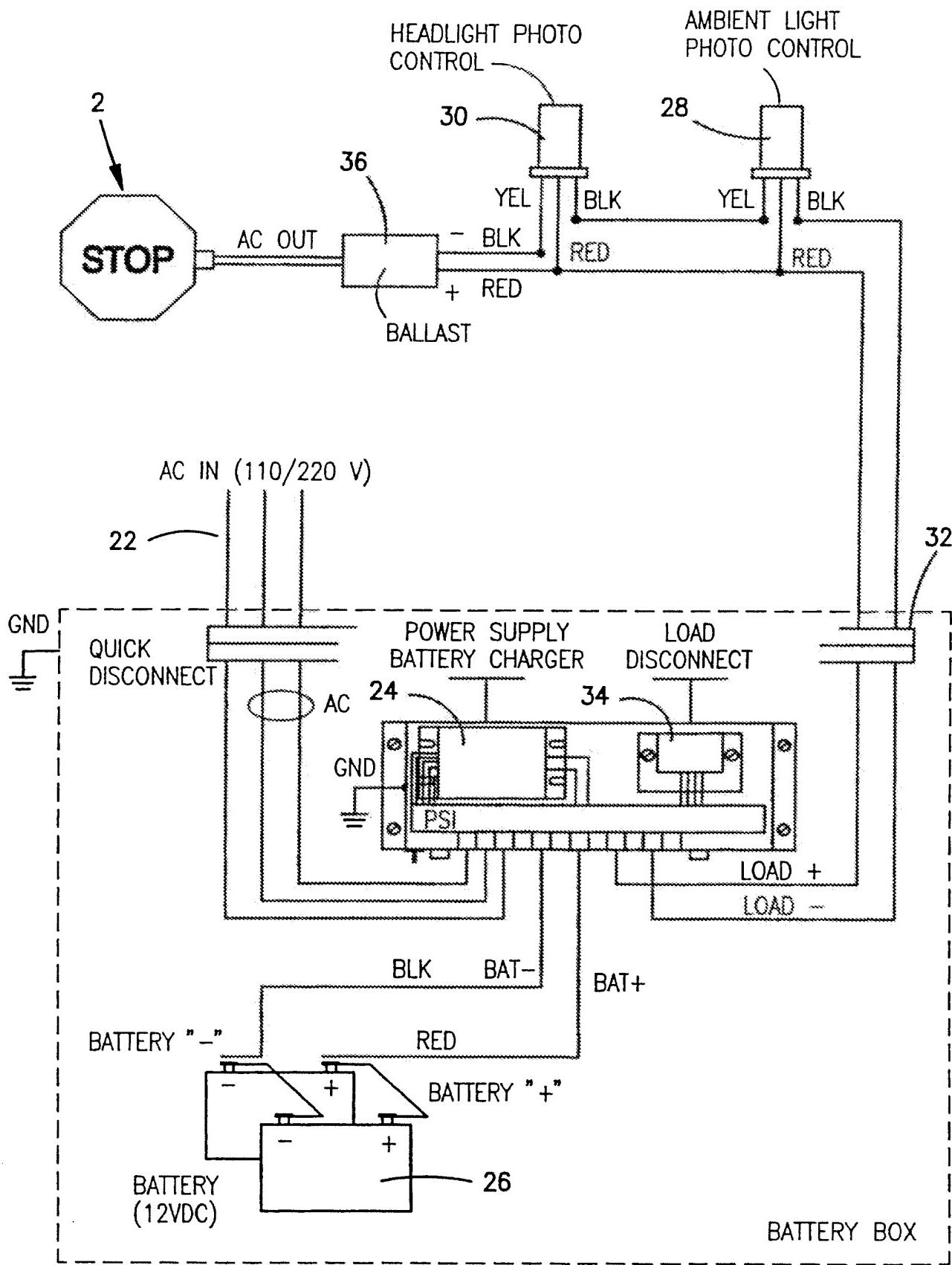


FIG. 4

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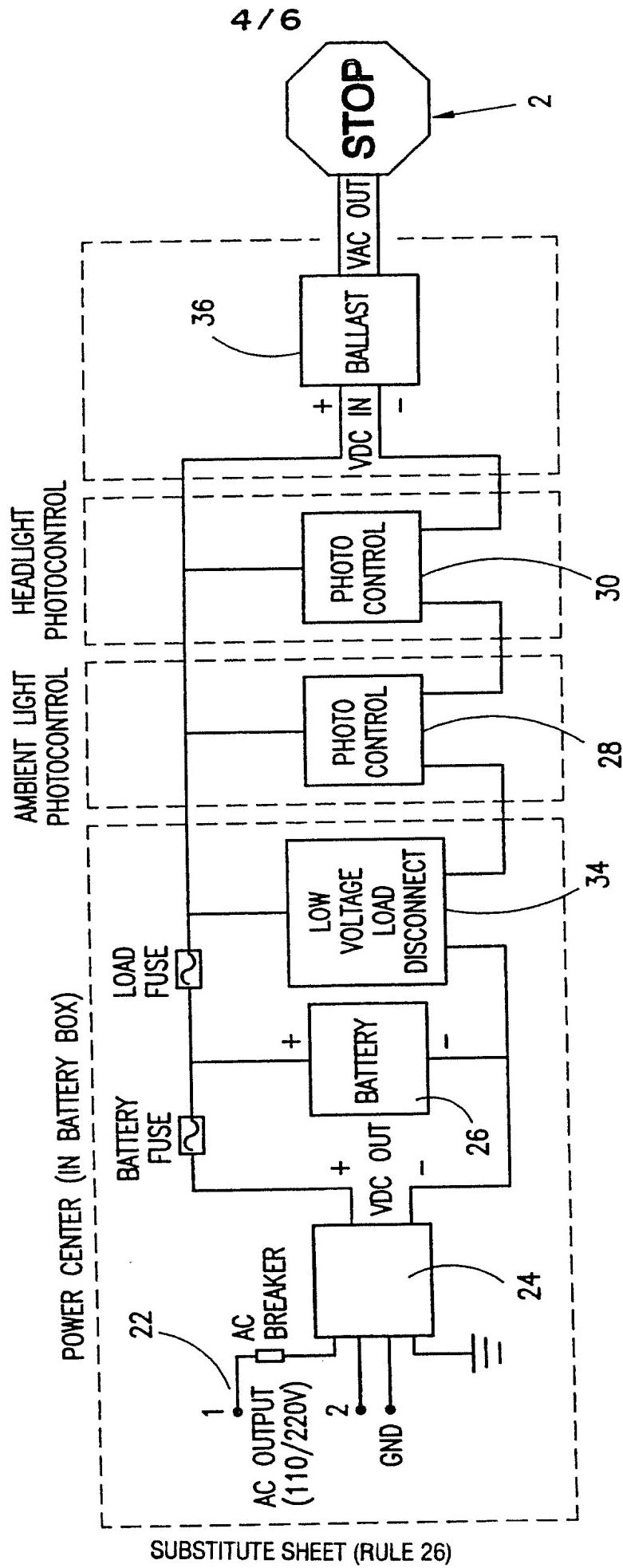
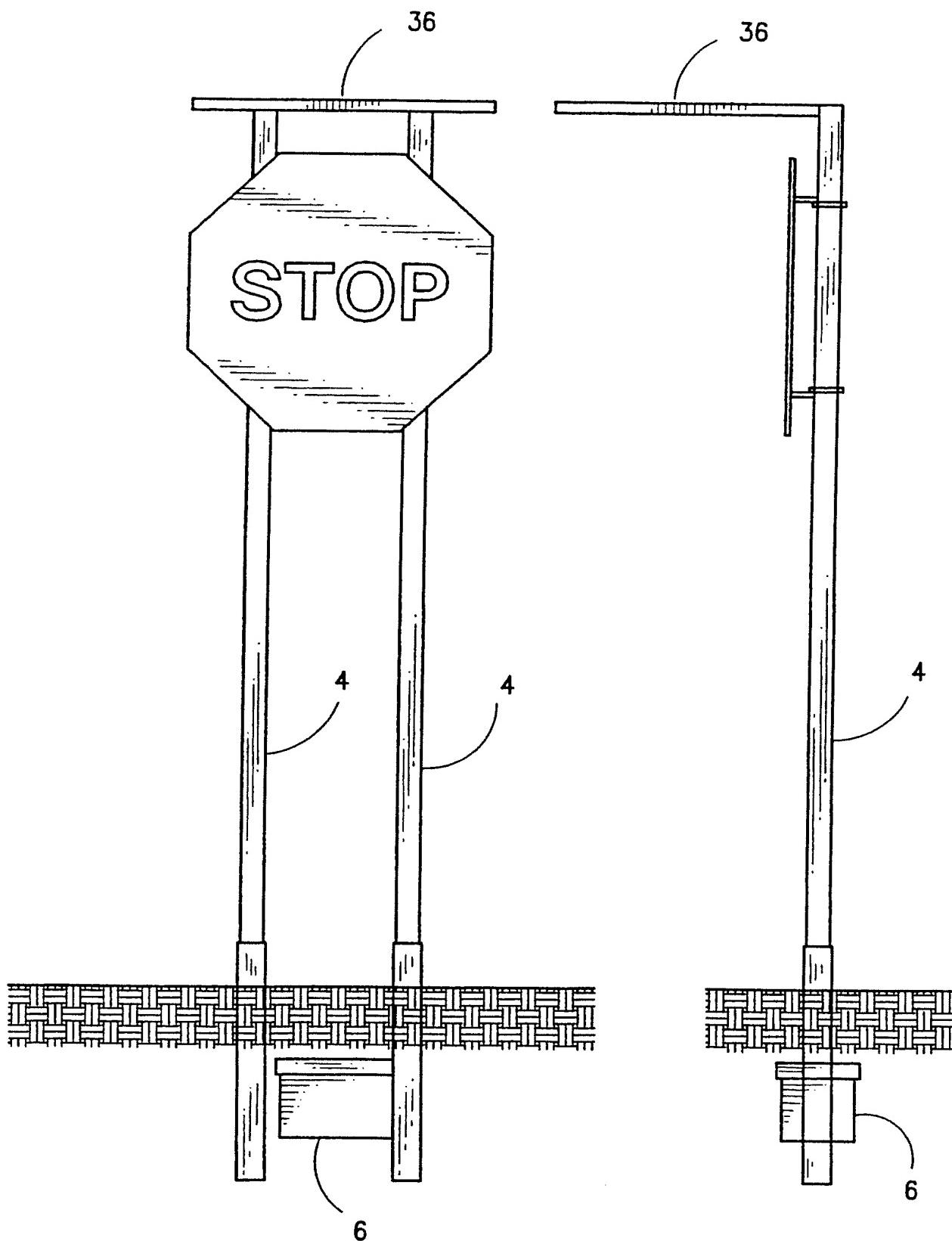


FIG. 5

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FIG. 7

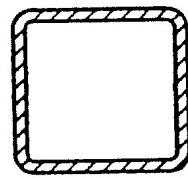
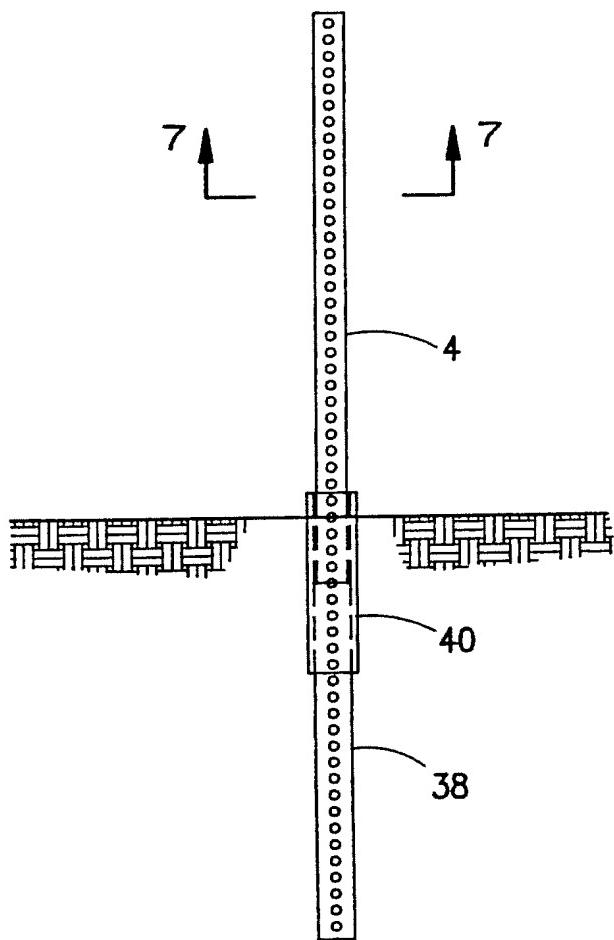


FIG. 8

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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US00/02504

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :G09F 15/00  
US CL :40/612, 544, 564; 345/207; 362/812

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
U.S. : 40/612, 544, 564, 463; 345/207; 362/812,157,183; 315/156,159,313

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
None

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
None

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	US 5,021,715 A (SMITH ET AL.) 04 JUNE 1991 (04/06/91), see figure 1.	1,2,3,9,16, and 19-22 ----- 4-8,10-15, 17,18, and 23-32
Y	US 4,952,023 A (BRADSHAW ET AL.) 28 AUGUST 1990 (28/08/90), see figure 1.	4,29,30
Y	US 5,709,045 A (THELEN) 20 JANUARY 1998 (20/01/98), see figure 2.	5-8,24,25, 28-32
Y	US 4,384,317 A (STACKPOLE) 17 MAY 1983 (17/05/83), see figure 7.	10 and 11
Y	US 5,134,550 A (YOUNG) 28 JULY 1992 (28/07/92), see column 3, lines 8-15.	12

Further documents are listed in the continuation of Box C.  See patent family annex.

* Special categories of cited documents.	*T*	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
*A* document defining the general state of the art which is not considered to be of particular relevance		
*E* earlier document published on or after the international filing date	*X*	document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
*L* document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*Y*	document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
*O* document referring to an oral disclosure, use, exhibition or other means		document member of the same patent family
*P* document published prior to the international filing date but later than the priority date claimed	*&*	

Date of the actual completion of the international search

11 MAY 2000

Date of mailing of the international search report

05 JUL 2000

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**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/US00/02504

**C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3,720,913 A (BRADFORD) 13 MARCH 1973 (13/03/73), see figure 1.	13-15 and 23-32
Y	US 5,160,111 A (HUGRON) 03 NOVEMBER 1992 (03/11/92), see figure 3.	17 and 18

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